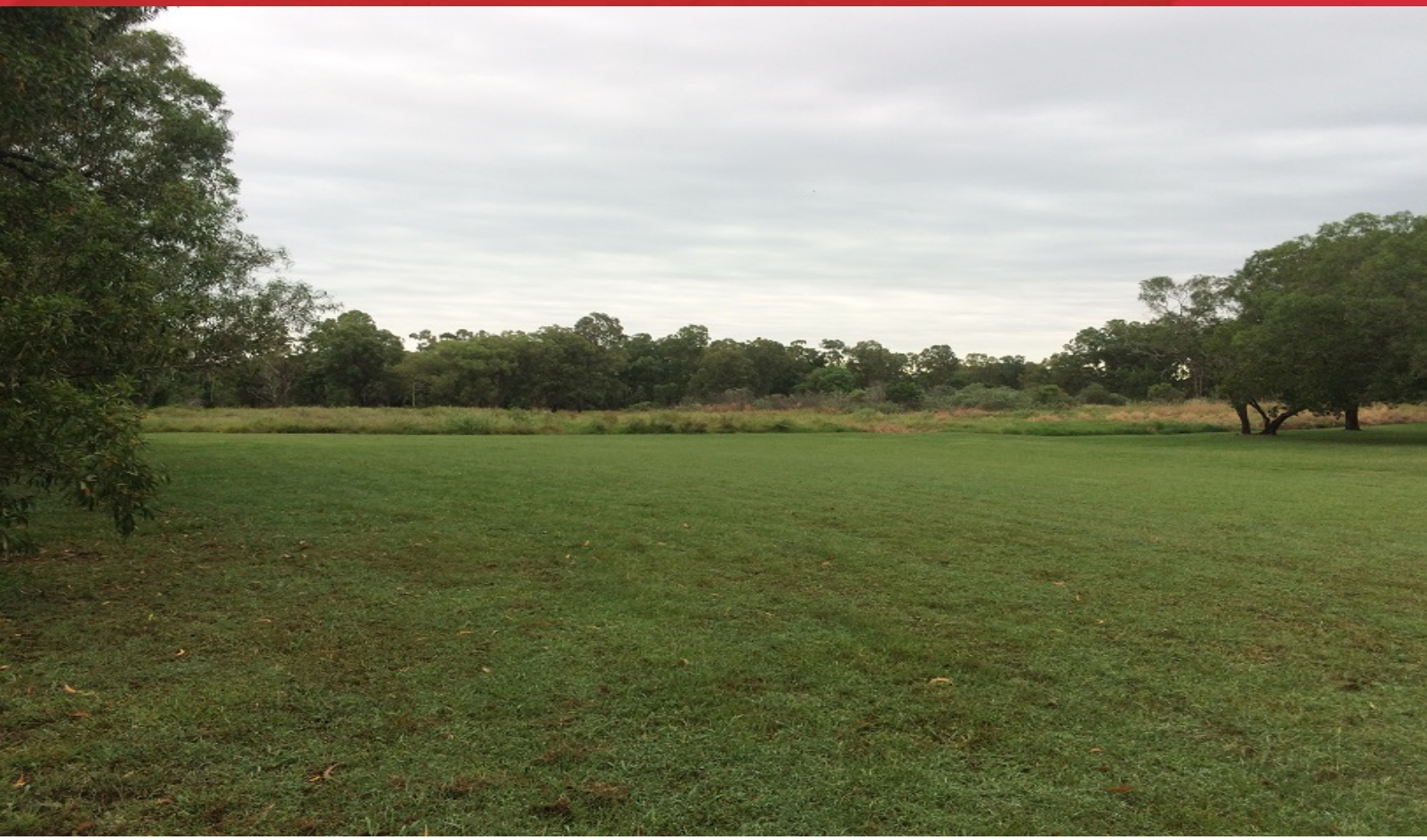
Environmental Management Plan
Soil Management Framework-
Marrara Detention Basin

DEPARTMENT OF INFRASTRUCTURE, PLANNING & LOGISTICS



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EXECUTIVE SUMMARY

The Northern Territory Government (NTG) is planning the construction of flood mitigation works to reduce the impacts of flooding to the suburbs of Rapid Creek and Milner.

Detailed site investigations have been undertaken, including the assessment of potential chemicals of concern in soils within the construction area. Low concentrations of perfluoroalkyl substances (PFAS), well below the health and ecological guideline values for low density residential settings, have been detected in soils from within the works area. Whilst the soils meet the guidelines for reuse without further management requirements, leachability of PFAS substances from these soils may exceed the guidelines for off-site disposal. This EMP provides a framework for managing soils to ensure that all off-site disposal meets the relevant guidelines with regard to PFAS substances in both soils and in leachates from these soils.

Under this EMP, management of earthworks during construction of flood mitigations works requires implementation of specific procedures for on-site reuse and off-site disposal of soil material. This includes:

- The Contractor shall ensure that all personnel involved in the operation and relocation of soil material are aware of the requirements of this EMP.
- All excavated soil material from areas recording PFAS concentrations in leachates ≥ 0.007 ug/L (as identified within this EMP) shall remain on-site and are suitable for re-use in the construction.
- All surplus soil from areas recording PFAS concentrations < 0.007 ug/L (as identified within this EMP) shall be restricted to off-site disposal at the Shoal Bay Waste Management Facility.
- No off-site disposal of soil material with PFAS concentrations ≥ 0.007 ug/L (or unknown concentrations).
- Tracking and recording of all soil material during construction.

The requirements outlined within this EMP are consistent with relevant legislation, industry guidelines and project approvals.

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ACRONYMS

DIPL	Department of Infrastructure, Planning and Logistics
EPA	Environment Protection Authority
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999, as revised in 2013
NT	Northern Territory
PFAS	Perfluoroalkyl and Polyfluoroalkyl substances
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate

1 INTRODUCTION

1.1 Background

The Northern Territory Government (NTG) is planning the construction of flood mitigation works (the works) to reduce the impacts of flooding to the suburbs of Rapid Creek and Milner. The works include the construction of a detention basin and associated drainage structures, located within a parcel of land at the corner of McMillans Road and Henry Wrigley Drive in Marrara. Stormwater flows will be directed to a detention basin via a series of culverts underneath Henry Wrigley Drive, with controlled discharge into Rapid Creek. Excavation of the basin will result in excess soils that will require off-site disposal.

Soil investigations undertaken on the construction site indicate low concentrations within *in-situ* soils of perflourohexane sulfonate (PFHxS), polyflouroalkyl (PFOS), and perflourooctanoic acid (PFOA)/PFOA – collectively referred to as perfluoroalkyl substances (PFAS) (EcOz 2017). Concentrations of PFAS substances (and heavy metals) in soils from within the works area are below the health and ecological guideline values for a low density residential setting (Residential 'A' as per the 2013 NEPM); and comply with the NSW Environment Protection Authority (NSW EPA) waste classification guidelines for general solid waste. However, locally (hot spots), the soils exceed the guideline values for PFAS substances (> 0.007 µg/L) in leachates for off-site disposal which requires retention on site in the compacted embankments for the detention basin and drains. Soils with leachates having < 0.007 µg/L PFAS substances may be disposed off-site and reused as earth fill in low density residential settings, provided these soils are not placed within ecologically sensitive areas (e.g. Reserves, National Parks, riparian areas).

1.2 Purpose

The purpose of this EMP is to ensure the safe, off-site disposal of excess soils, and thus the maintenance of health, safety and environmental protection during project implementation. This includes the following components:

- Compliance with applicable environmental legislation and project approvals.
- Mitigation of potential adverse impacts to the environment and human health associated with off-site disposal of soils containing low concentrations of PFAS in leachates.
- Provision of recommendations consistent with applicable guidelines.

This EMP is to be implemented in addition to the environmental requirements for projects detailed within the document *2013/2014 Standard Specification for Environmental Management* (Department of Infrastructure, 2013).

1.3 Scope

The scope of this EMP is to:

- Provide a soil management framework for construction of the works.
- Ensure PFAS related impacts associated with construction of the works, and off-site soil disposal, are minimised at all times.
- Identify and develop environmental controls for off-site disposal of excess soils during construction (including excavation, stockpiling and construction of the embankments).
- Identify and allocate roles and responsibilities of personnel involved in the works.
- Ensure compliance with all statutory and regulatory requirements.

1.4 Legislation and guidelines

The measures for managing and mitigating potential impacts of disposing excess soils off-site documented within this EMP are based on legislative requirements, statutory approvals and best practice guidelines.

This EMP does not negate the obligations of the Contractor to comply with any other applicable statutory requirement or obligation. Relevant legislation and guidelines are included in Table 1-1.

Table 1-1. Legislation and guidelines

NT Legislation	• *Dangerous Goods Act* • *Planning Act* • *Public and Environment Health Act* • *NT Work Health and Safety (National Uniform Legislation) Act* • *NT Water Act* • *NT Waste Management and Pollution Control Act*
Guidelines	• *Contaminated Land Guideline.* (NT EPA 2017). • *Prevent Pollution From Building Sites.* (NT EPA 2015). • *Preparation of an Environmental Management Plan.* (NT EPA 2015). • *National Environment Protection* (Assessment of Site Contamination) Measure (NEPM). (1999 – amended 2013). • *Assessment, management and remediation guidance for perfluorooctane-sulfonate (PFOS) and perfluorooctanoic acid (PFOA).* Cooperative Research Centre for Contamination, Assessment and Remediation of the Environment (CRC CARE) (2017). • *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), Version 2.1. Contaminated Sites Guidelines.* Department Environment Regulation (DER) Western Australia (2017). • *Designing Sampling Programs for Sites Potentially Contaminated by PFAS*. NSW EPA NSW (2016). • *Waste Classification Guidelines. Part 1: Classifying Waste*. NSW EPA (2014). • *2013/2014 Standard Specification for Environmental Management*. Department of Infrastructure (2013).

1.5 Roles and responsibilities

Roles and responsibilities during implementation of the works are described within Table 1-2.

Table 1-2. Roles and responsibilities

Role	Party/Person	Responsibilities
Superintendent	General Manager Infrastructure, Investment and Contracts, DIPL	Ensure that the requirements of this EMP are enforced under the construction Contract.
Environmental Consultant	EcOz	Develop the EMP in consultation with DIPL. Ensure that the EMP is maintained up-to-date in accordance with the document control procedure. Review the EMP, periodically and/or as required. Provide ongoing advice and recommendations in relation to implementation of this EMP. Provide environmental services during project implementation including environmental monitoring, investigation and reporting. Provide EMP updates/revisions as necessary, where requested by DIPL.
Site/Project Manager	Contractor	Administration and implementation of the requirements of this EMP to ensure that appropriate health, safety and environmental protection is in place. Development of strategies, processes and procedures to meet the requirements of this EMP. Ensure the EMP remains current and reflects on-site conditions and practices. Conduct ongoing site inspections and environmental monitoring to ensure adherence to this EMP. Implement environmental incident and complaints handling procedures. Identification, implementation and tracking of actions to ensure safety, health and environmental protection is maintained. Ensure all documentation associated with this EMP is maintained, and all inspection and monitoring records are available for review as and when required. Ensure that all personnel are made aware of the requirements of the EMP through appropriate education and training, prior to commencing work. Supervision of construction activities at all times. Conduct risk assessments and develop appropriate control measures for identified hazards (health, safety and environment). Record keeping of all training provided. Record keeping of all personnel, workers and visitors on site. Record keeping of all operational activities relevant to the management of PFAS including disposal of excess earthworks off-site.
All Site Personnel	All Contractors and Sub-contractors	Adherence to this EMP. Reporting of non-conformances and/or incidents to the Construction Project Manager. Compliance with all relevant OHS and environmental legislation. Participate in EMP updates/revisions as required.

2 PROJECT DETAILS

2.1 Site of work

The site of the works (Figure 1) includes three general locations:

- Section 4294 Hundred of Bagot, located on the corner of McMillans Rd and Henry Wrigley Drive, Marrara. The main detention basin and embankments will be constructed on this section.
- Section 5936 Hundred of Bagot, which is the adjacent netball court facility that is part the overall Marrara Sporting precinct. An open drain will be constructed on this section.
- Henry Wrigley Drive road reserve, for the construction of new culverts.

Some widening of existing drains will also be required within Section 4295 Hundred of Bagot.

The Contractor is required to obtain appropriate licences and approvals for any work required to be carried out in easements, or on land adjacent to the site for the purpose of connecting services or joining up of roads etc.

2.2 Description of the works

The works comprise the construction of a detention basin with embankments and associated drainage infrastructure, including open drains and culverts, in order reduce the impact of flood waters on the Rapid Creek floodplain.

Works are detailed within Project Engineering Drawings (refer Table 2-1), and include the following activities:

- Clearing, grubbing and topsoil stripping.
- Bulk earthworks, including cut and fill, importing and placing granular filter material, and disposal of excess excavated material.
- Blending and working selected excavated earth materials at controlled moisture contents to produce fill for a water retaining embankment.
- Landscaping, including revegetation with grasses, trees and shrubs, and provision of temporary irrigation to enable establishment.
- Drainage structures, including open drains, box culverts, headwalls and protection works using various concrete, rock, rock filled mattress and geotextile treatments.
- Other miscellaneous construction including concrete works, road pavements, fencing and signage.

Relevant engineering plans and drawings are listed in Table 2-1.

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Table 2-1. Project engineering drawings

Drawing Reference	Title	Date
R17-1402 to R17-1404	Construction Access Requirements – Sheets 1-3. Marrara Drain and Rapid Creek Detention Basin	17/02/2017
R16-4547	Locality Plan & Drawing Schedule	31/03/2017
R16-4548	Notes	31/03/2017
R16-4549	General Arrangement Site Plan	31/03/2017
R16-4550 to R16-4552	Detention Basin Plan	31/03/2017
R16-4553	Detention Basin Longitudinal Sections	31/03/2017
R16-4554 & R16-4555	Drain Longitudinal Sections & Typical Cross sections	31/03/2017
R16-4556	Detention Basin Typical Sections	31/03/2017
R16-4557 & R16-4558	Culvert Sections	31/03/2017
R16-4559	Detention Basin Details	31/03/2017
R16-4560 to R16-4563	Details	31/03/2017
R16-4564 to R16-4565	Culvert Inlet/Outlet Details	31/03/2017
R16-4566	Landscaping Plan	31/03/2017
R16-4567	Earthworks	31/03/2017
R16-4568 to R16-4569	Culvert 1 and 3 – Apron Slab, Head Wall and Wing Wall Structural Details	31/03/2017
R16-4570 to R16-4571	Culvert 2 – Apron Slab, Head Wall and Wing Wall Structural Details	31/03/2017
R16-4572 to R16-4573	Culvert 4 – Apron Slab, Head Wall and Wing Wall Structural Details	31/03/2017
R16-4574 to R16-4575	Culvert 5 – Apron Slab, Head Wall and Wing Wall Structural Details	31/03/2017
R16-4576	Culvert 1 and 3 – Inlet Screen. Plan and Details	31/03/2017
R16-4577	Culvert 4 – Inlet Screen. Plan and Details	31/03/2017
R16-4578	Culvert 5 – Inlet Screen. Plan and Details	31/03/2017
R16-4579	Culvert 1 Inspection Pit. Structural Details	31/03/2017

3 EARTHWORKS MANAGEMENT

The Contractor is responsible for management of all earthwork activities during construction, including:

- Development and implementation of procedures and practices consistent with the requirements of this EMP.
- Ensuring that all personnel involved in the operation and relocation of soil material are aware of the requirements of this EMP.
- Establishment of site, comprising identification of works boundary, no-go and exclusion zones and construction access.
- Excavation of soils and rock from within the site of works including the southern drain (Drain 1) and detention basin area.
- Processing, stockpiling, hauling, placing and compacting soils for earthworks in fill including construction of embankments.
- Reuse and on-site retention of excavated soils exceeding PFAS concentration threshold (≥ 0.007 ug/L).
- Restricted off-site disposal of surplus soil within PFAS concentration threshold (< 0.007 ug/L).
- Off-site disposal of excavated rock.
- Off-site disposal of miscellaneous buried building rubble.

3.1 Materials balance

The overarching objective is to retain all materials, excluding those from the zones indicated as < 0.001 µg/L and < 0.007 µg/L for construction of the embankments (Figure 1). Should any off-site disposal be necessary, then priorities are as follows:

1. First priority for off-site disposal is removal of soils from the zone demarcated as < 0.001 µg/L (). The soils available for off-site disposal from this area amount to approximately 25,270 m^3 (Table 3-1).
2. Second priority for off-site disposal is removal of soils from the zone demarcated < 0.007 µg/L (Figure 1). The soils available for off-site disposal from this area amounts to approximately 16,280 m^3 (Table 3-1).

The total volume of soil potentially available for off-site disposal amount to approximately 41,556 m^3. While these soils are suitable for re-use as fill for low density residential and/or commercial/industrial developments, soils are to be disposed of to the Shoal Bay Waste Management Facility. Soils are not permitted to be disposed of in ecologically sensitive areas (e.g. Reserves, National Parks, riparian areas).

Table 3-1. Estimated soil volumes suitable for off-site disposal

Soil leachate concentration	Est volume (m3)
Soils with leachate concentrations of PFAS substances <0.001µg/L (refer Figure 1).	25,270
Soils with leachate concentrations of PFAS substances between 0.001µg/L and <0.007µg/L (refer Figure 1).	16,280
Soils with concentrations of PFAS substances <0.007µg/L	41,556

Notes:

- Bulking factors were not applied.
- Volumes are calculated from existing surface level to design finished surface level.

Table 3-2 provides an estimated material balance for overall earthworks quantities. Based on material balance estimates (Table 3-1), there is sufficient quantity of soils having PFAS leachate concentration < 0.001 µg/L (25,270 m^3) to meet off-site soil disposal quantity (19,737 m^3).

Table 3-2. Estimated materials balance - earthworks

Material source	Est volume (m^3)
Detention basin and embankments - cut	88,777
Southern drain and culverts - cut	3,349
Total Cut Materials (A)	**92,126**
Main Basin and Embankments - fill	41,901
Southern Drain and HWD Culverts - fill	2,263
Total Fill Materials (B)	**44,164**
Excess Rock	28,225
Excess Soil	19,737
Potential Excess Material for Re-Use/Disposal (A-B)	**47,962**

Notes:

- Bulking factors were not applied.
- Volumes calculated from existing surface level to design finished surface level.

3.2 Earthworks tracking

Earthworks are to be managed so as to record all material movement as per the following:

- The details of earthworks movements are traceable and are to be recorded in accordance with the Project Specification.
- The Contractor is required to produce a Lot Plan which will accurately identify the Earthworks Zones.
- The Contractor is required to prepare Inspection and Test Plans (ITP's), for approval by DIPL prior to the commencement of any earthworks. The ITP's must include all details relevant to the Lot. Refer to the Project Specification for further details.

- A material log is to be used to track all off-site earthworks movements. The Contractor shall maintain the material log and provide daily materials balance to the Environmental Consultant.

3.3 Stockpiling

No stockpiling shall be permitted on material having PFAS leachate concentration of < 0.001 ug/L (Figure 1).

Stockpiling will only be allowed in designated areas approved by the Environmental Consultant.

3.4 Off-site disposal

Off-site disposal of all excess soil material resulting from excavation is to be managed as follows (refer Figure 1):

- All approved excess soil material shall be disposed of off-site at the Shoal Bay Waste Management Facility.
- Excess soil requiring off-site disposal is to be from within areas identified as having PFAS leachate concentrations < 0.001 µg/L as first priority.
- Additional excess soil requiring off-site disposal is to be from within areas identified as having PFAS leachate concentrations < 0.007 µg/L.
- All approved excess rock material shall be removed and disposed of off-site at the Shoal Bay Waste Management Facility.
- Soil materials with PFAS leachate concentrations ≥ 0.007 µg/L are to remain on-site at all times, and used in construction of the embankments. Further laboratory analysis will be required for soils outside the < 0.007 µg/L areas should they require off-site disposal, with the exception of rock. The Contractor shall confirm classification of all rock material with the Environmental Consultant.
- The Environmental Consultant shall supervise and approve all rock and soil material identified for off-site disposal.
- Details of material for disposal off-site are to be recorded within the material log, including the source location (Lot), leachate threshold (< 0.001 ug/L or < 0.007 ug/L), vehicle registration, date/time, check of load (signed by Environmental Consultant), destination and approximate volume of soil.
- The material log must be in in triplicate with one copy retained by the Contractor and one by the Environmental Consultant (for inclusion in a Closure Report). Where off-site disposal is undertaken, the third copy must be signed by the receiver at the destination and returned to the Environmental Consultant.

Marrara Detention Basin and Drainage Materials Balance	Volume (m^3)
Main Basin and Embankments	88,777
Southern Drain and HWD Culverts	3,349
Project Total Cut Materials	**92,126**
Main Basin and Embankments	41,901
Southern Drain and HWD Culverts	2,263
Project Total Fill Materials	**44,164**
Excess Material (Rock and Overburden/Spoils) for Re-Use/Disposal	**47,962**
Rock for Off-Site Disposal and Re-Use (Unsuitable for Construction)	**28,225**
Excess Soils for Off-Site Disposal and Re-Use (Minimum)	**19,737**
Soils with leachate concentrations of PFAS substances <0.001µg/L	**25,270**
Soils with leachate concentrations of PFAS substances between 0.001µg/L and <0.007µg/L	**16,280**
Soils with concentrations of PFAS substances <0.007µg/L	**41,556**

Bulking factors were not applied; volumes calculated from nominal surface level to depth of excavation for flood detention basin.

Map 1

Map 2

Darwin

Contours
Z5G3(L) Leachate test result exceeds leachate threshold ≥0.007 µg/L
Z5G38A Calculated leachate value exceeds leachate threshold ≥0.007 µg/L
Z5G42C Calculated leachate value exceeds leachate threshold ≥0.007 µg/L
Control line
Batter
Works boundary

Area below leachate threshold
Threshold
0.001 ug/L
0.07 ug/L

0 25 50 100
Metres

MAP INFORMATION
Scale: 1:2,000 @ A4
Projection: GDA 1994 MGA Zone 52
Date Saved: 16/02/2018
Client: Halikos Construction
Author: K.Munson (reviewed T.Elder)
DATA SOURCE
Project data: EcOz, Halikos
Imagery: ESRI basemap

Figure 1. PFOS+PFHxS Leachate Concentrations

4 INCIDENT REPORTING

4.1 Community liaison

Construction activities which have the potential to disrupt residents or occupiers use of their premises are to be managed as per the *2013/2014 Standard Specification for Environmental Management*. This includes management of complaints. Preventative measures will be subject to review, as determined by the Superintendent.

4.2 Incident recording

Environmental monitoring, auditing, and recording/reporting of non-conformances are to be in accordance with the *2013/2014 Standard Specification for Environmental Management.*

Should an environmental incident occur during the course of site works, the Construction Project Manager shall immediately notify the Superintendent. The Construction Project Manager shall take prompt and immediate action to minimise any impact and liaise with all relevant authorities as required. The Construction Project Manager shall, in liaison with the Superintendent, direct an appropriate course of action, recording the following details:

- The date, time and nature of the incident.
- Full details of the causes and effects (refer Section 5.1: Notifications).
- Further investigations to be undertaken.
- Person responsible for such investigations.
- Outcomes of the investigation.
- Actions and resolution of the incident including preventative measures implemented to prevent recurrence.

Preventative measures shall be subject to monitoring and review. Incidents shall be included in any audit reports during site works.

Corrective actions may be agreed upon, dependent upon the severity of the non-conformance, incident and/or emergency, between the Contractor(s), DIPL and/or the relevant authority.

4.3 Incident notification

In the event of an incident and/or an emergency that causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm, the Construction Project Manager shall notify the Superintendent, and relevant authority as soon as practicable after being made aware of the incident or emergency, The Construction Project Manager shall record the following information:

- Number of the Building Licence/Development Approval/Site Reference.
- Name and telephone number of the designated contact person (if not Site Manager).
- Location of the incident.
- Time of the incident and the time the Construction Project Manager became aware thereof.
- Cause or suspected cause of the incident.
- The environmental harm caused, threatened, or suspected to be caused by the incident.

- Details of immediate actions taken to limit environmental harm.
- Details of actions to be implemented to inhibit further damage and/or prevent recurrence of similar incidents.
- Actions taken to mitigate any environmental harm caused by the incident.

The Construction Project Manager shall report, in writing, subsequent environmental monitoring in relation to the incident or emergency to the administering authority no later than six weeks after the incident.

5 REFERENCES

Department of Infrastructure (2013). *2013/2014 Standard Specification for Environmental Management.* Palmerston, NT.

EcOz Environmental Consultants (2107). *Detailed Site Investigation: Marrara Detention Basin.* [unpublished].

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